# Complete Summary

## GUIDELINE TITLE

ACC/AHA 2004 guideline update for coronary artery bypass graft surgery: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1999 Guidelines for Coronary Artery Bypass Graft Surgery).

## BIBLIOGRAPHIC SOURCE(S)

Eagle KA, Guyton RA, Davidoff R, Edwards FH, Ewy GA, Gardner TJ, Hart JC, Herrmann HC, Hillis LD, Hutter AM Jr, Lytle BW, Marlow RA, Nugent WC, Orszulak TA. ACC/AHA 2004 guideline update for coronary artery bypass graft surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Bethesda (MD): American College of Cardiology; 2004. 99 p. [795 references]

## GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: American College of Cardiology, American Heart Association, Eagle KA, Guyton RA, Davidoff R, Ewy GA, Fonger J, Gott JP, Herrmann HC, Marlow RA, Nugent WC, O'Connor GT, Orszulak TA, Rieselbach RE, Winters WL, Yusuf S, Gibbons RJ, Alpert JS, Eagle KA, Garson A Jr, Gregoratos G, Russell RO, Smith SC Jr. ACC/AHA Guidelines for coronary artery bypass graft surgery. J Am Coll Cardiol 1999 Oct;34(4):1262-347.

This document will be reviewed one year after the date of publication and yearly thereafter by the Task Force to determine whether a revision is needed. The guidelines will be considered current, unless the Task Force publishes revisions or a withdrawal.

## ** REGULATORY ALERT **

## FDA WARNING/REGULATORY ALERT

**Note from the National Guideline Clearinghouse**: This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- August 16, 2007, Coumadin (Warfarin): Updates to the labeling for Coumadin to include pharmacogenomics information to explain that people's genetic makeup may influence how they respond to the drug.
- May 2, 2007, Antidepressant drugs: Update to the existing black box warning on the prescribing information on all antidepressant medications to include

warnings about the increased risks of suicidal thinking and behavior in young adults ages 18 to 24 years old during the first one to two months of treatment.

- October 6, 2006, Coumadin (warfarin sodium): Revisions to the labeling for Coumadin to include a new patient Medication Guide as well as a reorganization and highlighting of the current safety information to better inform providers and patients.

## COMPLETE SUMMARY CONTENT



## SCOPE

### DISEASE/CONDITION(S)

Coronary artery diseases (CAD) including asymptomatic or mild angina, stable angina, unstable angina/non-ST-segment elevation myocardial infarction (MI), ST-segment elevation myocardial infarction (STEMI), poor left ventricular (LV) function, and life-threatening ventricular arrhythmias

### GUIDELINE CATEGORY

Prevention
Screening
Treatment

### CLINICAL SPECIALTY

Family Practice
Pediatrics
Preventive Medicine

### INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Nurses
Physician Assistants
Physicians

## GUIDELINE OBJECTIVE(S)

To assist physicians in clinical decision making by presenting recommendations regarding the appropriate use of coronary artery bypass graft (CABG) surgery

## TARGET POPULATION

Adults with coronary artery disease

**Note**: Special patient subsets include the elderly (≥70 years); women; patients with diabetes; patients with pulmonary disease, chronic obstructive pulmonary disease (COPD), or respiratory insufficiency; patients with end-stage renal disease; patients with valve disease; patients with a prior history of coronary artery bypass graft (CABG); patients with concomitant peripheral vascular disease (PVD); patients with poor left ventricular (LV) function; transplantation patients; and patients with acute coronary syndromes.

## INTERVENTIONS AND PRACTICES CONSIDERED

### Evaluation/Risk Assessment

1. Echocardiography
2. Carotid screening (carotid duplex ultrasound)
3. Left ventricular (LV) function
4. Ejection fraction (EF)
5. Assessment of cardiac biomarkers including creatine kinase-muscle band (CK-MB) and troponin T

### Management/Treatment

1. Coronary artery bypass graft (CABG) surgery
2. Medical therapy (preoperative and postoperative) including:
    - Beta-blockers
    - Nitrates
    - Calcium channel blockers (Note: nondihydropyridine calcium channel blockers are not recommended for prophylaxis of arrhythmias though they are useful for control of ventricular rate)
    - Anti-arrhythmic agents (e.g., sotalol, amiodarone)
    - Anticoagulants (warfarin, aspirin)
    - Lipid-lowering agents (e.g., statins)
    - Angiotensin-converting enzyme inhibitors
    - Digoxin (not recommended for prophylaxis of arrhythmias though useful for control of ventricular rate)
    - Prophylactic antibiotic administration (e.g., cephalosporins such as cefuroxime, cefamandole, or cefazolin; vancomycin for penicillin allergic)
    - Hormone therapy (not recommended)
3. Percutaneous coronary intervention (PCI)
4. Transmyocardial surgical laser revascularization
5. Carotid endarterectomy
6. Aortic valve replacement
7. Prophylactic intra-aortic balloon pump
8. Smoking cessation therapy (nicotine replacement and bupropion)
9. Cardiac rehabilitation

### MAJOR OUTCOMES CONSIDERED

- Relief of symptoms of angina
- Morbidity and mortality including:
    - Long-term survival after bypass surgery (total mortality at 5 and 10 years)
    - Hospital mortality
    - Adverse cerebral outcomes
    - Mediastinitis
    - Renal dysfunction
- Predictive value of tests
- Quality of life
- Length of hospitalization
- Incidence of myocardial infarction (MI) including ST segment elevation
- Incidence of perioperative stroke
- Incidence of neurological injury
- Incidence of perioperative myocardial dysfunction
- Repeat revascularization rates

## METHODOLOGY

### METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

### DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The Committee reviewed pertinent publications, including abstracts, through a computerized search of the English literature since 1999 and performed a manual search of final articles. Special attention was devoted to identification of randomized trials published since the original document.

### NUMBER OF SOURCE DOCUMENTS

Not stated

### METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

### RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

**Level of Evidence**

**Level of Evidence A**: Data derived from multiple randomized clinical trials or meta-analyses
**Level of Evidence B**: Data derived from a single randomized trial, or

nonrandomized studies
**Level of Evidence C**: Only consensus opinion of experts, case studies, or standard-of-care

## METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

## DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

A complete listing of all publications covering coronary bypass surgery in the past 4 years is beyond the scope of this document. However, evidence tables were updated to reflect major advances over this time period. Inaccuracies or inconsistencies present in the original publication were identified and corrected when possible.

## METHODS USED TO FORMULATE THE RECOMMENDATIONS

Balance Sheets
Expert Consensus

## DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Experts in the subject under consideration are selected from the American College of Cardiology and the American Heart Association to examine subject-specific data and write guidelines. The process includes additional representatives from other medical specialty groups when appropriate. Writing groups are specifically charged to perform a formal literature review, weigh the strength of evidence for or against a particular treatment or procedure, and include estimates of expected health outcomes where data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that might influence the choice of particular tests or therapies are considered as well as frequency of follow-up and cost-effectiveness.

Since the initial guidelines for coronary artery bypass graft (CABG) surgery were published in 1991, there has been additional evolution in the surgical approach to coronary disease while at the same time there have been significant advances in preventive, medical, and percutaneous catheter approaches to therapy.

The current Writing Committee was charged with updating the guidelines published in 1999.All of the recommendations in this guideline update have been written in full sentences that express a complete thought, such that a recommendation, even if separated and presented apart from the rest of the document, would still convey the full intent of the recommendation. It is hoped that this will increase readers' comprehension of the guidelines. Also, the level of evidence, either A, B, or C, for each recommendation (see "Rating Scheme for the Strength of the Evidence" above), is now provided.

## RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

**Class I**: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective.

**Class II**: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness or efficacy of a procedure or treatment.

> **Class IIa**: Weight of evidence/opinion is in favor of usefulness/efficacy.
>
> **Class IIb**: Usefulness/efficacy is less well established by evidence/opinion.

**Class III**: Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/effective and in some cases may be harmful.

## COST ANALYSIS

### Cardiac Rehabilitation

In addition to benefiting a sense of well-being, there is an economic benefit that accrues from participation in cardiac rehabilitation programs. During a 3-year follow-up (mean of 21 months) after coronary events (58% of events were coronary bypass operations), per capita hospitalization charges were $739 lower for rehabilitated patients compared with nonparticipants ($1,197 $\pm$ 3,911 versus $1,936 $\pm$ 5,459, $P$ = 0.022).

### Coronary Artery Bypass Graft (CABG)

#### *Cost-Effectiveness of CABG*

CABG represents a major investment for society, with an initial hospital cost of around $30,000 applied to more than 300,000 patients annually in the United States alone (around 10 billion dollars). It is most appropriate to consider the cost of CABG surgery compared with other medical treatment modalities with regard to cost-effectiveness. Definitive data for such a comparison are sparse, and multiple assumptions must be made. The most reasonable system of analysis appears to be an estimation of the dollars spent per quality-adjusted life-year gained ($/QALY). In general, a cost-effectiveness of $20,000 to $40,000/QALY is consistent with other medical programs funded by society, such as hemodialysis and treatment of hypertension. A cost of under $20,000/QALY would be considered particularly cost-effective, while a cost greater than $60,000/QALY would be considered expensive. (Note: The dollar amounts given here are in 1993 dollars).

A widely quoted analysis of the cost-effectiveness of CABG surgery was compiled in 1982 utilizing data gathered from the then available randomized trials comparing medical therapy with coronary artery bypass. The cost of coronary bypass is relatively constant, whether it is conducted for left main disease or for single-vessel disease.

Cost-effectiveness is excellent when the procedure is applied to patient subgroups for whom the benefit in terms of survival or relief of symptoms compared with medical therapy is great (as it would be, for example, in a patient with severe

angina and triple-vessel disease). The cost-effectiveness of CABG becomes inordinately poor, however, when the benefit in terms of survival is marginal and there are few symptoms in the preoperative patient. These conclusions are depicted in Figure 12 in the original guideline document, and examples are presented in Table 18 in the original guideline document. Cost-effectiveness for coronary bypass in patients with left main disease is exceptionally good at $9,000/QALY. It is similarly quite attractive in patients with 3-vessel disease, at $18,000/QALY. If one considers the cost-effectiveness of coronary bypass in 2-vessel disease, one study found that the presence or absence of left anterior descending (LAD) disease was very important. Because CABG surgery is particularly effective in relieving angina, its cost-effectiveness, even in patients with single-vessel disease, is not prohibitive if that patient has severe angina. In the patient without angina or with only mild angina, however, the cost of coronary bypass per QALY was prohibitive in this analysis, exceeding $100,000 for patients with 2-vessel or 1-vessel disease.

It is not surprising that coronary bypass surgery is cost-effective in exactly those groups of patients in whom survival and/or symptomatic benefit is demonstrable. Most important, within these subsets the cost-effectiveness of coronary bypass compares favorably with other generally accepted medical therapies.

***Cost Comparison With Angioplasty***

The cost-effectiveness of angioplasty is dependent on the pre-angioplasty symptoms of the patient in the same way that CABG surgery is so dependent, particularly in subgroups in whom revascularization cannot be shown to have a survival benefit compared with medical therapy (i.e., in single-vessel disease). Because it relieves angina, angioplasty for single-vessel-disease patients with severe angina is estimated to have a cost-effectiveness of $9,000/QALY. In patients with only mild angina, however, angioplasty in the setting of LAD single-vessel disease is estimated to have a poor cost-effectiveness of $92,000/QALY.

A direct comparison of the cost of angioplasty and coronary bypass surgery for selected patients with multivessel disease (i.e., those patients for whom either therapeutic modality was considered appropriate) has been made in the randomized trials of angioplasty versus CABG. In general, the cost analyses of randomized trials have revealed that the initial cost of angioplasty is about 50 to 65% of the initial cost of bypass surgery. The incremental cost of repeated procedures during the follow-up period has led to a cumulative cost of angioplasty that approaches the cumulative cost of bypass surgery at 3 years. The Emory Angioplasty versus Surgery Trial (EAST) found that the 3-year inpatient cost of angioplasty was 94% of that of bypass surgery. The Randomized Intervention Treatment of Angina (RITA) Trial, which included a large number of patients with single-vessel disease, found that the 2-year cumulative cost of angioplasty was 80% of the cost of coronary bypass. The Bypass Angioplasty Revascularization Investigation (BARI) trial conducted a prospectively designed analysis of the comparative cost of the 2 procedures from a subgroup of the participating centers, comprising a total of 934 of the 1,829 patients enrolled. The mean initial hospital cost of angioplasty was 65% of that of surgery, but after 5 years the cumulative cost of initial surgical therapy was only $2,700 more than the cumulative cost of initial angioplasty (around a 5% difference). Because the surgical cohort had a higher overall 5-year survival, the cost of this survival benefit could be calculated. It was found to be $26,000/y of survival benefit for

surgical therapy of 2-and 3-vessel disease (in patients for whom either angioplasty or surgery was considered appropriate initial therapy). As considered in the previous section, this incremental cost for double- and triple-vessel disease is within the range of costs for generally accepted therapies. It is notable that this cost of incremental benefit does not consider the benefit of coronary bypass in terms of relief of angina during the follow-up interval, which was demonstrated in each of these 3 trials (Bypass Angioplasty Revascularization Investigation, Emory Angioplasty versus Surgery Trial, and Randomized Intervention Treatment of Angina). If this factor were included, the *cost-effectiveness* of CABG for incremental benefit in these selected patients with multivessel disease ($/QALY) would be <$26,000.

Previous considerations of both patient benefit and cost-effectiveness have suggested that angioplasty is less effective for patients with more advanced disease. Data gathered at Duke University has shown that there is a significant cost gradient for angioplasty as the extent of disease increases (related to repeated procedures whose instance may be reduced by stents), which is not apparent for coronary bypass.

The use of drug-eluting stents in percutaneous revascularization will require a re-evaluation of cost-effectiveness considerations. The initial procedure is considerably more expensive (equaling the cost of CABG in many patients with multivessel disease), but the recurring cost of reintervention for restenosis will be dramatically reduced. Cost-effectiveness will depend on pricing of stents, utilization rates of the more expensive stents, and efficacy. All of these factors are evolving rapidly.

***Cost Reduction in Coronary Bypass***

Estimates presented in the previous portion of this section suggest that coronary bypass has been cost-effective in the last 2 decades. Initiatives to decrease the length of stay by using clinical pathways and standardized fast-track protocols have reduced hospital costs. Indeed, the estimates made by Weinstein and Stason are distinctly dated: improvements in outcomes and shortened lengths of hospitalization are likely to have considerably improved the cost-effectiveness of CABG (and angioplasty) since 1982.

Studies from the 1980s suggested that by concentrating CABG procedures into high-volume institutions, the overall cost of providing coronary surgical revascularization would be reduced owing to efficiencies of scale. Shahian et al studied this question and found no relationship between either hospital size or annual CABG case volume and cost of performing bypass surgery.

A major innovation has been the introduction of off-bypass CABG, which has reduced the postprocedure length of stay in some centers to between 2 and 3 days. In some centers, this has led to a total 3-month cost for single-vessel coronary bypass that is not significantly different from the total 3-month cost for angioplasty of single-vessel disease. Considering the favorable long-term patency of an internal mammary artery (IMA) graft to the LAD, the cost reductions possible with off-bypass CABG may improve the relative cost-effectiveness of coronary bypass compared with either medical therapy or percutaneous techniques, particularly for symptomatic, proximal LAD disease.

## METHOD OF GUIDELINE VALIDATION

Comparison with Guidelines from Other Groups
External Peer Review
Internal Peer Review

## DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The original guideline document was reviewed by 3 outside observers nominated by the American College of Cardiology (ACC), 3 outside reviewers nominated by the American Heart Association (AHA), one content reviewer from the Task Force on Practice Guidelines, and outside reviewers nominated by the Society of Thoracic Surgeons (STS) and the Society of Cardiovascular Anesthesiologists.

The ACC/AHA 2004 Guideline Update for Coronary Artery Bypass graft (CABG) was approved for publication by the ACC Foundation (ACCF) Board of Trustees in March 2004 and the AHA Science and Advisory Coordinating Committee in June 2004, and was endorsed by the American Association for Thoracic Surgery and the STS.

# RECOMMENDATIONS

## MAJOR RECOMMENDATIONS

*Note from the National Guideline Clearinghouse (NGC)*: The recommendations listed below are from the Summary Article (see "Companion Documents" field). Readers are referred to the full-text original guideline document for context.

Levels of evidence (A-C) and classes of recommendations (I, IIa, IIb, and III) are defined at the end of the "Major Recommendations" field.

### Outcomes

### Hospital Outcomes

*Predicting Hospital Mortality*

*Class IIa*

1. It is reasonable to use statistical risk models to obtain objective estimates of coronary artery bypass graft (CABG) operative mortality. *(Level of Evidence: C)*

*Morbidity Associated with CABG: Adverse Cerebral Outcomes*

*Class I*

1. Significant atherosclerosis of the ascending aorta mandates a surgical approach that will minimize the possibility of arteriosclerotic emboli. *(Level of Evidence: C)*

## Management Strategies

### Reduction of Perioperative Mortality and Morbidity

*Reducing the Risk of Brain Dysfunction After CABG*

Atrial Fibrillation and Postoperative Stroke

*Class IIa*

1. In post-CABG atrial fibrillation that is recurrent or persists more than 24 hours, warfarin anticoagulation for 4 weeks is probably indicated. *(Level of Evidence: C)*

Recent Anterior Myocardial Infarction (MI), Left Ventricular (LV) Mural Thrombus, and Stroke Risk

*Class IIa*

1. Long-term (3 to 6 months) anticoagulation is probably indicated for the patient with recent anteroapical infarct and persistent wall-motion abnormality after CABG. *(Level of Evidence: C)*

*Class IIb*

1. In patients having a recent anterior MI, preoperative screening with echocardiography may be considered to detect left ventricular (LV) thrombus, because the technical approach and timing of surgery may be altered. *(Level of Evidence: C)*

Carotid Disease and Neurological Risk Reduction

*Class IIa*

1. Carotid endarterectomy is probably recommended before CABG or concomitant to CABG in patients with a symptomatic carotid stenosis or in asymptomatic patients with a unilateral or bilateral internal carotid stenosis of 80% or more. (*Level of Evidence: C)*
2. Carotid screening is probably indicated in the following subsets: age greater than 65 years, left main coronary stenosis, peripheral vascular disease, history of smoking, history of transient ischemic attack or stroke, or carotid bruit on examination. *(Level of Evidence: C)*

*Reducing the Risk of Perioperative Myocardial Dysfunction*

Myocardial Protection for Acutely Depressed Cardiac Function

*Class I*

1. Blood cardioplegia should be considered in patients undergoing cardiopulmonary bypass accompanying urgent/emergency CABG for acute MI or unstable angina. *(Level of Evidence: B)*

Protection for Chronically Dysfunctional Myocardium

*Class IIa*

1. Blood cardioplegia is probably indicated in patients undergoing cardiopulmonary bypass accompanying CABG in the presence of a chronically dysfunctional left ventricle. *(Level of Evidence: B)*

Cardiac Biomarker Elevation and Outcome

*Class IIb*

1. Assessment of cardiac biomarkers in the first 24 hours after CABG may be considered, and patients with the highest elevations of creatine kinase-muscle band (MB) (greater than 5 times upper limits of normal) are at increased risk of subsequent events. *(Level of Evidence: B)*

Adjuncts to Myocardial Protection

*Class IIa*

1. The use of a prophylactic intra-aortic balloon pump (IABP) as an adjunct to myocardial protection is probably indicated in patients with evidence of ongoing myocardial ischemia and/or patients with a subnormal cardiac index. *(Level of Evidence: B)*

Inferior Infarct with Right Ventricular Involvement

*Class IIa*

1. After infarction that leads to clinically significant right ventricular dysfunction, it is reasonable to delay surgery for 4 weeks to allow recovery. *(Level of Evidence: C)*

*Reducing the Risk of Perioperative Infection*

*Class I*

1. Preoperative antibiotic administration should be used in all patients to reduce the risk of postoperative infection. *(Level of Evidence: A)*
2. In the absence of complicating circumstances, a deep sternal wound infection should be treated with aggressive surgical debridement and early revascularized muscle flap coverage. *(Level of Evidence: B)*

*Class IIa*

1. The risk for deep sternal wound infection is reduced by aggressive control of perioperative hyperglycemia by using a continuous, intravenous insulin infusion. (Furnary et al., 1999) *(Level of Evidence: B)*

*Prevention of Postoperative Arrhythmias*

*Class I*

1. Preoperative or early postoperative administration of beta-blockers in patients without contraindications should be used as the standard therapy to reduce the incidence and/or clinical sequelae of atrial fibrillation after CABG. *(Level of Evidence: B)*

*Class IIa*

1. Preoperative administration of amiodarone reduces the incidence of postcardiotomy atrial fibrillation and is an appropriate prophylactic therapy for patients at high risk for postoperative atrial fibrillation who have contraindications to therapy with beta-blockers. *(Level of Evidence: B)*
2. Digoxin and nondihydropyridine calcium-channel blockers are useful for control of ventricular rate but at present have no indication for prophylaxis. *(Level of Evidence: B)*

*Class IIb*

1. Low-dose sotalol can be considered to reduce the incidence of atrial fibrillation after CABG in patients who are not candidates for traditional beta-blockers. *(Level of Evidence: B)*

**Maximizing Postoperative Benefit**

*Antiplatelet Therapy for Saphenous Vein Graft (SVG) Patency*

*Class I*

1. Aspirin is the drug of choice for prophylaxis against early saphenous vein graft closure. It is the standard of care and should be continued indefinitely given its benefit in preventing subsequent clinical events. *(Level of Evidence: A)*

*Pharmacological Management of Hyperlipidemia*

*Class I*

1. All patients undergoing CABG should receive statin therapy unless otherwise contraindicated. *(Level of Evidence: A)*

*Hormonal Manipulation*

*Class III*

1. Initiation of hormone therapy is not recommended for women undergoing CABG surgery. *(Level of Evidence: B)*

*Smoking Cessation*

*Class I*

1. All smokers should receive educational counseling and be offered smoking cessation therapy after CABG. *(Level of Evidence: B)*
2. Pharmacological therapy including nicotine replacement and bupropion should be offered to select patients indicating a willingness to quit. *(Level of Evidence: B)*

*Cardiac Rehabilitation*

*Class I*

1. Cardiac rehabilitation should be offered to all eligible patients after CABG. *(Level of Evidence: B)*

**Special Patient Subsets**

**Valve Disease**

*Class I*

1. Patients undergoing CABG who have severe aortic stenosis (mean gradient greater than or equal to 50 mm Hg or Doppler velocity greater than or equal to 4 meters per second) who meet the criteria for valve replacement should have concomitant aortic valve replacement. *(Level of Evidence: B)*

*Class IIa*

1. For a preoperative diagnosis of clinically significant mitral regurgitation concomitant mitral correction at the time of CABG is probably indicated. *(Level of Evidence: B)*
2. In patients undergoing CABG who have moderate aortic stenosis and are at acceptable risk for aortic valve replacement (mean gradient 30 to 50 mm Hg or Doppler velocity 3 to 4 meters per second), concomitant aortic valve replacement is probably indicated. *(Level of Evidence: B)*

*Class IIb*

1. Patients undergoing CABG who have mild aortic stenosis (mean gradient less than 30 mm Hg or Doppler velocity less than 3 meters per second) may be considered candidates for aortic valve replacement if the risk of the combined procedure is acceptable. *(Level of Evidence: C)*

**CABG in Acute Coronary Syndromes**

*Class I*

1. If clinical circumstances permit, clopidogrel should be withheld for 5 days before the performance of CABG surgery. *(Level of Evidence: B)*

**Impact of Evolving Technology**

**Arterial and Alternate Conduits**

*Class I*

1. In every patient undergoing CABG, the left internal mammary artery (IMA) should be given primary consideration for revascularization of the left anterior descending (LAD) artery. *(Level of Evidence: B)*

**Transmyocardial Laser Revascularization (TMLR) (refer to the TMR section of the Stable Angina Update)**

*Class IIa*

1. Transmyocardial surgical laser revascularization, either alone or in combination with CABG, is reasonable in patients with angina refractory to medical therapy who are not candidates for percutaneous coronary intervention (PCI) or surgical revascularization. *(Level of Evidence: A)*

**Indications**

**Clinical Subsets**

*Asymptomatic or Mild Angina*

*Class I*

1. CABG should be performed in patients with no angina or mild angina who have significant left main coronary artery stenosis. *(Level of Evidence: A)*
2. CABG should be performed in patients with no angina or mild angina who have left main equivalent: significant (greater than or equal to 70%) stenosis of the proximal LAD and proximal left circumflex artery. *(Level of Evidence: A)*
3. CABG is useful in patients with no angina or mild angina who have 3-vessel disease. (Survival benefit is greater in patients with abnormal LV function; e.g., ejection fraction [EF] less than 0.50 and/or large areas of demonstrable myocardial ischemia.) *(Level of Evidence: C)*

*Class IIa*

1. CABG can be beneficial for patients with no angina or mild angina who have proximal LAD stenosis with 1- or 2-vessel disease. (This recommendation becomes Class I if extensive ischemia is documented by a noninvasive study and/or left ventricular ejection fraction (LVEF) is less than 0.50.) *(Level of Evidence: A)*

*Class IIb*

1. CABG may be considered for patients with no angina or mild angina who have 1- or 2-vessel disease not involving the proximal LAD. (If a large area of viable myocardium and high-risk criteria are met on noninvasive testing, this recommendation becomes Class I). *(Level of Evidence: B)*

*Stable Angina*

*Class I*

1. CABG is recommended for patients with stable angina who have significant left main coronary artery stenosis. *(Level of Evidence: A*)
2. CABG is recommended for patients with stable angina who have left main equivalent: significant (greater than or equal to 70%) stenosis of the proximal LAD and proximal left circumflex artery. *(Level of Evidence: A)*
3. CABG is recommended for patients with stable angina who have 3-vessel disease. (Survival benefit is greater when LVEF is less than 0.50.) *(Level of Evidence: A)*
4. CABG is recommended in patients with stable angina who have 2-vessel disease with significant proximal LAD stenosis and either EF less than 0.50 or demonstrable ischemia on noninvasive testing. *(Level of Evidence: A)*
5. CABG is beneficial for patients with stable angina who have 1- or 2-vessel coronary artery disease (CAD) without significant proximal LAD stenosis but with a large area of viable myocardium and high-risk criteria on noninvasive testing. *(Level of Evidence: B)*
6. CABG is beneficial for patients with stable angina who have developed disabling angina despite maximal noninvasive therapy, when surgery can be performed with acceptable risk. If the angina is not typical, objective evidence of ischemia should be obtained. *(Level of Evidence: B)*

*Class IIa*

1. CABG is reasonable in patients with stable angina who have proximal LAD stenosis with 1-vessel disease. (This recommendation becomes Class I if extensive ischemia is documented by noninvasive study and/or LVEF is less than 0.50.) *(Level of Evidence: A)*
2. CABG may be useful for patients with stable angina who have 1- or 2-vessel CAD without significant proximal LAD stenosis but who have a moderate area of viable myocardium and demonstrable ischemia on noninvasive testing. *(Level of Evidence: B)*

*Class III*

1. CABG is not recommended for patients with stable angina who have 1- or 2-vessel disease not involving significant proximal LAD stenosis, patients who have mild symptoms that are unlikely due to myocardial ischemia, or patients who have not received an adequate trial of medical therapy and:
    a. Have only a small area of viable myocardium *(Level of Evidence: B)* or
    b. Have no demonstrable ischemia on noninvasive testing. *(Level of Evidence: B)*

2. CABG is not recommended for patients with stable angina who have borderline coronary stenoses (50 to 60% diameter in locations other than the left main coronary artery) and no demonstrable ischemia on noninvasive testing. *(Level of Evidence: B)*
3. CABG is not recommended for patients with stable angina who have insignificant coronary stenosis (less than 50% diameter reduction). *(Level of Evidence: B)*

*Unstable Angina/Non-ST-Segment Elevation Myocardial infarction (MI)*

*Class I*

1. CABG should be performed for patients with unstable angina/non–ST-segment elevation MI with significant left main coronary artery stenosis. *(Level of Evidence: A)*
2. CABG should be performed for patients with unstable angina/non–ST-segment elevation MI who have left main equivalent: significant (greater than or equal to 70%) stenosis of the proximal LAD and proximal left circumflex artery. *(Level of Evidence: A)*
3. CABG is recommended for unstable angina/non–ST-segment elevation MI in patients in whom percutaneous revascularization is not optimal or possible, and who have ongoing ischemia not responsive to maximal nonsurgical therapy. *(Level of Evidence: B)*

*Class IIa*

1. CABG is probably indicated in patients with unstable angina/non–ST-segment elevation MI who have proximal LAD stenosis with 1- or 2-vessel disease. *(Level of Evidence: A)*

*Class IIb*

1. CABG may be considered in patients with unstable angina/non–ST-segment elevation MI who have 1- or 2-vessel disease not involving the proximal LAD when percutaneous revascularization is not optimal or possible. (If there is a large area of viable myocardium and high-risk criteria are met on noninvasive testing, this recommendation becomes Class I.) *(Level of Evidence: B)*

*ST-Segment Elevation MI (STEMI)*

*Class I*

1. Emergency or urgent CABG in patients with STEMI should be undertaken in the following circumstances:
    a. Failed angioplasty with persistent pain or hemodynamic instability in patients with coronary anatomy suitable for surgery. *(Level of Evidence: B)*
    b. Persistent or recurrent ischemia refractory to medical therapy in patients who have coronary anatomy suitable for surgery, who have a significant area of myocardium at risk, and who are not candidates for percutaneous coronary intervention *(Level of Evidence: B)*

c. At the time of surgical repair of postinfarction ventricular septal rupture or mitral valve insufficiency. *(Level of Evidence: B)*
d. Cardiogenic shock in patients less than 75 years old with ST-segment elevation or left bundle-branch block or posterior MI who develop shock within 36 hours of MI and are suitable for revascularization that can be performed within 18 hours of shock, unless further support is futile because of the patient's wishes or contraindications/unsuitability for further invasive care. *(Level of Evidence: A)*
e. Life-threatening ventricular arrhythmias in the presence of greater than or equal to 50% left main stenosis and/or triple-vessel disease. *(Level of Evidence: B)*

*Class IIa*

1. CABG may be performed as primary reperfusion in patients who have suitable anatomy and who are not candidates for or who have had failed fibrinolysis/PCI and who are in the early hours (6 to 12 hours) of evolving STEMI *(Level of Evidence: B)*
2. In patients who have had an ST-segment elevation MI or non–ST-segment elevation MI, CABG mortality is elevated for the first 3 to 7 days after infarction, and the benefit of revascularization must be balanced against this increased risk. Beyond 7 days after infarction, the criteria for revascularization described in previous sections are applicable. *(Level of Evidence: B)*

*Class III*

1. Emergency CABG should not be performed in patients with persistent angina and a small area of myocardium at risk who are hemodynamically stable. *(Level of Evidence: C)*
2. Emergency CABG should not be performed in patients with successful epicardial reperfusion but unsuccessful microvascular reperfusion. *(Level of Evidence: C)*

*Poor LV Function*

*Class I*

1. CABG should be performed in patients with poor LV function who have significant left main coronary artery stenosis. *(Level of Evidence: B)*
2. CABG should be performed in patients with poor LV function who have left main equivalent: significant (greater than or equal to 70%) stenosis of the proximal LAD and proximal left circumflex artery. *(Level of Evidence: B)*
3. CABG should be performed in patients with poor LV function who have proximal LAD stenosis with 2- or 3-vessel disease. *(Level of Evidence: B)*

*Class IIa*

1. CABG may be performed in patients with poor LV function with significant viable noncontracting, revascularizable myocardium and without any of the above anatomic patterns. *(Level of Evidence: B)*

*Class III*

1. CABG should not be performed in patients with poor LV function without evidence of intermittent ischemia and without evidence of significant revascularizable viable myocardium. *(Level of Evidence: B)*

*Life-Threatening Ventricular Arrhythmias*

*Class I*

1. CABG should be performed in patients with life-threatening ventricular arrhythmias caused by left main coronary artery stenosis. *(Level of Evidence: B)*
2. CABG should be performed in patients with life-threatening ventricular arrhythmias caused by 3-vessel coronary disease. *(Level of Evidence: B)*

*Class IIa*

1. CABG is reasonable in bypassable 1- or 2-vessel disease causing life-threatening ventricular arrhythmias. (This becomes a Class I recommendation if the arrhythmia is resuscitated sudden cardiac death or sustained ventricular tachycardia.) *(Level of Evidence: B)*
2. CABG is reasonable in life-threatening ventricular arrhythmias caused by proximal LAD disease with 1- or 2-vessel disease. (This becomes a Class I recommendation if the arrhythmia is resuscitated sudden cardiac death or sustained ventricular tachycardia.) *(Level of Evidence: B)*

*Class III*

1. CABG is not recommended in ventricular tachycardia with scar and no evidence of ischemia. *(Level of Evidence: B)*

*CABG After Failed Percutaneous Transluminal Coronary Angioplasty (PTCA)*

*Class I*

1. CABG should be performed after failed PTCA in the presence of ongoing ischemia or threatened occlusion with significant myocardium at risk. *(Level of Evidence: B)*
2. CABG should be performed after failed PTCA for hemodynamic compromise. *(Level of Evidence: B)*

*Class IIa*

1. It is reasonable to perform CABG after failed PTCA for a foreign body in crucial anatomic position. *(Level of Evidence: C)*
2. CABG can be beneficial after failed PTCA for hemodynamic compromise in patients with impairment of the coagulation system and without previous sternotomy. *(Level of Evidence: C)*

*Class IIb*

1. CABG can be considered after failed PTCA for hemodynamic compromise in patients with impairment of the coagulation system and with previous sternotomy. *(Level of Evidence: C)*

*Class III*

1. CABG is not recommended after failed PTCA in the absence of ischemia. *(Level of Evidence: C)*
2. CABG is not recommended after failed PTCA with inability to revascularize due to target anatomy or no-reflow state. *(Level of Evidence: C)*

*Patients With Previous CABG*

*Class I*

1. Coronary bypass should be performed in patients with prior CABG for disabling angina despite optimal nonsurgical therapy. (If angina is not typical, then objective evidence of ischemia should be obtained.) *(Level of Evidence: B)*
2. Coronary bypass should be performed in patients with prior CABG without patent bypass grafts but with Class I indications for surgery for native-vessel coronary artery disease (significant left main coronary stenosis, left main equivalent, 3-vessel disease). *(Level of Evidence: B)*

*Class IIa*

1. Coronary bypass is reasonable in patients with prior CABG and bypassable distal vessel(s) with a large area of threatened myocardium by noninvasive studies. *(Level of Evidence: B)*
2. Coronary bypass is reasonable in patients with prior CABG if atherosclerotic vein grafts with stenoses greater than 50% supplying the LAD coronary artery or large areas of myocardium are present. *(Level of Evidence: B)*

**Definitions**:

**Levels of Evidence**

**Level of Evidence A**: Data derived from multiple randomized clinical trials or meta-analyses
**Level of Evidence B**: Data derived from a single randomized trial, or nonrandomized studies
**Level of Evidence C**: Only consensus opinion of experts, case studies, or standard-of-care

**Classes of Recommendations**

**Class I**: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective.

**Class II**: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness or efficacy of a procedure or treatment.

**Class IIa**: Weight of evidence/opinion is in favor of usefulness/efficacy.

**Class IIb**: Usefulness/efficacy is less well established by evidence/opinion.

**Class III**: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful.

### CLINICAL ALGORITHM(S)

None provided

## EVIDENCE SUPPORTING THE RECOMMENDATIONS

### REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation.

Recommendations provided in this document are based primarily on published data. Because randomized trials are unavailable in many facets of coronary artery disease (CAD) treatment, observational studies and, in some areas, expert opinion form the basis for recommendations that are offered. In each section of the Indications (see Section 9 of the original guideline document), the relative levels of evidence favoring the Class I, II, and III indications were noted.

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

- Increased familiarity with new evidence on coronary artery bypass graft (CABG) surgery
- Improved clinical decision making regarding appropriate use of CABG surgery
- Improved short- and long-term patient outcomes and satisfaction

### POTENTIAL HARMS

#### Morbidity Associated With Bypass Surgery

- *Neurological Events*

  Neurological abnormalities after coronary artery bypass graft (CABG) are a dreaded complication. The reported incidence ranges from 0.4% to nearly 80%, depending on how the deficit is defined. Neurological derangement after

CABG has been attributed to hypoxia, emboli, hemorrhage, and metabolic abnormalities. Despite the many advances made in cardiac surgery, postoperative stroke remains a problem. Postoperative neurological deficits have been divided into 2 types: type 1 deficits are those associated with major, focal neurological deficits, stupor, and coma; type 2 deficits are characterized by deterioration in intellectual function or memory. Please refer to the full text of the original guideline document for a complete discussion of adverse cerebral outcomes and estimation of individual patient risk.

- *Mediastinitis*

  Deep sternal wound infection has been reported to occur in 1 to 4% of patients after CABG and carries a mortality rate of nearly 25%. Studies have consistently associated obesity and reoperation with this complication, while other risk factors such as use of both internal mammary arteries, duration and complexity of operation, and the presence of diabetes have been reported inconsistently. Most studies examining deep sternal wound infection have been single-center, retrospective reviews, and variation in wound surveillance techniques and the definition of deep sternal wound infection limit comparisons. Please refer to the full text of the original guideline document for a complete discussion of post-CABG mediastinitis and estimation of individual patient risk.

- *Renal Dysfunction*

  The first major multicenter study of renal dysfunction after CABG surgery was published in 1998. This study of 2,222 patients who underwent myocardial revascularization with cardiopulmonary bypass defined postoperative renal dysfunction (PRD) as a postoperative serum creatinine level of greater than or equal to 2.0 mg/dL or an increase in the serum creatinine level of greater than or equal to 0.7 mg/dL from preoperative to maximum postoperative values. PRD occurred in 171 (7.7%) of the patients studied; 30 of these (18%, or 1.4% of all study patients) required dialysis. The mortality rates were 0.9% among patients who did not develop PRD, 19% in patients with PRD who did not require dialysis, and 63% among those who required dialysis. Several preoperative risk factors for PRD were identified, including advanced age, a history of moderate to severe congestive heart failure (CHF), prior CABG, type 1 diabetes mellitus, and preexisting renal disease (preoperative creatinine levels greater than 1.4 mg/dL). The risk of PRD in patients less than 70 years of age nearly tripled with 1 preoperative risk factor and increased further with 2 risk factors. A detailed analysis of the impact of these preoperative risk factors for PRD for 3 age groups is presented in Table 4 of the full text of the original guideline document. These findings allow identification of high-risk patients for PRD and a general estimation of the risk for PRD for an individual patient. The reported risk for patients with moderate renal dysfunction is consistent with previous reports from smaller, single-center studies.

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

These guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the healthcare provider and patient in light of all the circumstances presented by that patient.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

The context within which coronary surgery is performed will ultimately influence the outcome experienced by patients. Because of the highly technical nature of the procedure and the narrow clinical margin of the patient population, strategies to ensure consistent care have evolved. These strategies include establishing specialized cardiac surgical centers, forming multidisciplinary clinical teams within hospitals, and creating and implementing clinical pathways, care maps, algorithms, and protocols.

Appropriately implemented clinical guidelines have been shown to improve the processes of clinical care in 90% of cases and show measurable improvement of outcome in 20% of cases. Successful application of clinical guidelines require they be accompanied by unambiguous statement of purpose, that clinicians for whom they are intended have some role in their creation or implementation, and that forcing functions, such as clinical pathways, algorithms, or protocols, be tied to the guidelines.

Whereas clinical practice guidelines describe an ideal treatment strategy for a particular disease process, clinical pathways (a.k.a. critical pathways, care maps) represent the optimal sequence of timing of interventions for a particular diagnosis or procedure. Well-designed clinical pathways ensure care is delivered as prescribed by a practice guideline while optimizing resource utilization, minimizing chance of error, and allowing for the reinvention of these standards within the context of local culture. They are typically created for patient populations that are large in number, relatively homogeneous in appearance, and consume large amounts of resources and have thus been found ideal for the coronary artery bypass graft (CABG) population.

### IMPLEMENTATION TOOLS

Foreign Language Translations
Patient Resources
Personal Digital Assistant (PDA) Downloads
Pocket Guide/Reference Cards
Tool Kits

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Staying Healthy

### IOM DOMAIN

Effectiveness
Patient-centeredness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Eagle KA, Guyton RA, Davidoff R, Edwards FH, Ewy GA, Gardner TJ, Hart JC, Herrmann HC, Hillis LD, Hutter AM Jr, Lytle BW, Marlow RA, Nugent WC, Orszulak TA. ACC/AHA 2004 guideline update for coronary artery bypass graft surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Bethesda (MD): American College of Cardiology; 2004. 99 p. [795 references]

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

1999 Oct (revised 2004)

### GUIDELINE DEVELOPER(S)

American College of Cardiology Foundation - Medical Specialty Society
American Heart Association - Professional Association

### SOURCE(S) OF FUNDING

The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA). No outside funding accepted.

### GUIDELINE COMMITTEE

American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1999 Guidelines for Coronary Artery Bypass Graft Surgery)

### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

The Committee consists of acknowledged experts in cardiac surgery, interventional cardiology, general cardiology, internal medicine, and family practice. The Committee included representatives from the American Academy of Family Physicians (AAFP) and the American College of Physicians (ACP), as well as the Society for Thoracic Surgery (STS). Both academic and private practice sectors were represented.

*Writing Committee Members*: Kim A. Eagle, MD, FACC, FAHA (Co-chair); Robert A. Guyton, MD, FACC, FAHA (Co-chair); Ravin Davidoff, MB, BCh, FACC, FAHA; Fred H. Edwards, MD, FACC, FAHA; Gordon A. Ewy, MD, FACC, FAHA; Timothy J. Gardner, MD, FACC, FAHA; James C. Hart, MD, FACC; Howard C. Herrmann, MD, FACC, FAHA; L. David Hillis, MD, FACC; Adolph M. Hutter, Jr., MD, MACC, FAHA; Bruce Whitney Lytle, MD, FACC; Robert A. Marlow, MD, MA, FAAFP; William C. Nugent, MD; Thomas A. Orszulak, MD, FACC

*Task Force Members*: Elliott M. Antman, MD, FACC, FAHA (Chair); Sidney C. Smith, Jr., MD, FACC, FAHA (Vice Chair); Joseph S. Alpert, MD, FACC, FAHA*; Jeffrey L. Anderson, MD, FACC, FAHA; David P. Faxon, MD, FACC, FAHA; Valentin Fuster, MD, PhD FACC, FAHA; Raymond J. Gibbons, MD, FACC, FAHA*#; Gabriel Gregoratos, MD, FACC, FAHA*; Jonathan L. Halperin, MD, FACC, FAHA; Loren F. Hiratzka, MD, FACC, FAHA; Sharon Ann Hunt, MD, FACC, FAHA; Alice K. Jacobs, MD, FACC, FAHA; Joseph P. Ornato, MD, FACC, FAHA

*Former Task Force Member

#Immediate Past Chair

## FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The American College of Cardiology/American Heart Association (ACC/AHA) Task Force on Practice Guidelines makes every effort to avoid any actual or potential conflicts of interest that might arise as a result of an outside relationship or personal interest of a member of the writing panel. Specifically, all members of the writing panel are asked to provide disclosure statements of all such relationships that might be perceived as real or potential conflicts of interest. These statements are reviewed by the parent task force, reported orally to all members of the writing panel at the first meeting, and updated yearly and as changes occur.

The relationships with industry information for the writing committee members is posted on the ACC (www.acc.org) and AHA (www.americanheart.org) Web sites with the full-length version of the update (see Appendix 1 below), along with the names and relationships with industry of the peer reviewers (see Appendix 2 below).

Appendix 1: ACC/AHA Committee to Update the 1999 Guidelines for Coronary Artery Bypass Graft Surgery – Relationships with Industry

| Committee Member Name | Research Grant | Speakers/ Bureau /Honoraria | Stock Ownership | Consultant |
|---|---|---|---|---|
| Dr. Kim A. Eagle | Sanofiaventis<br>Pfizer<br>Blue Cross/Blue Shield | None | None | National Institutes of Health<br>Sanofiaventis |
| Dr. Robert A. Guyton | Medtronic, Inc<br>Quest Medical, Inc.<br>Chase Medical, | None | None | Medtronic, Inc. |

| Committee Member Name | Research Grant | Speakers/ Bureau /Honoraria | Stock Ownership | Consultant |
|---|---|---|---|---|
| | Inc. | | | |
| Dr. Ravin Davidoff | None | None | None | None |
| Dr. Fred H. Edwards | None | None | None | None |
| Dr. Gordon A. Ewy | None | Pfizer<br>Merck<br>GlaxoSmithKline<br>Wyeth | None | None |
| Dr. Timothy J. Gardner | None | None | None | None |
| Dr. James C. Hart | Medtronic, Inc.<br>CardioVations | Medtronic, Inc.<br>Novare | None | Medtronic, Inc.<br>St. Jude Medical<br>CardioVations |
| Dr. Howard C. Herrmann | Johnson & Johnson<br>Boston Scientific<br>Pfizer<br>Merck<br>Millennium | Johnson & Johnson<br>Pfizer | Johnson & Johnson | Johnson & Johnson<br>Boston Scientific<br>Merck |
| Dr. L. David Hillis | None | None | None | None |
| Dr. Adolph M. Hutter | None | None | None | None |
| Dr. Bruce Whitney Lytle | None | None | None | None |
| Dr. Robert A. Marlow | None | None | None | None |
| Dr. William C. Nugent | None | None | None | None |
| Dr. Thomas A. Orszulak | None | None | None | None |

**Note**: This table represents the relationships of committee members with industry that were disclosed at the initial writing committee meeting in March 2002 and updated in conjunction with all meetings and conference calls of the writing committee. It does not necessarily reflect relationships with industry at the time of publication.

Appendix 2: External Peer Reviewers for the ACC/AHA 2004 Guideline Update for Coronary Artery Bypass Graft Surgery*

| Reviewer Name** | Reviewer Category and Affiliation | Relationships with Industry |
|---|---|---|
| Dr. Robert H. Jones | Official Reviewer - ACC (Board of Trustees) | None |
| Dr. Edward H. Williams | Official Reviewer - ACC (Board of Governors) | None |
| Dr. Loren F. | Official Reviewer - ACC/AHA | None |

| Reviewer Name** | Reviewer Category and Affiliation | Relationships with Industry |
|---|---|---|
| Hiratzka | Task Force on Practice Guidelines | |
| Dr. Irving L. Kron | Official Reviewer - AHA | None |
| Dr. Irvin B. Krukenkamp | Official Reviewer - AHA | None |
| Dr. E. Magnus Ohman | Official Reviewer - AHA | Stock Holder: Medtronic Research Grants: Berlex, Millennium, BMS, Sanofi-Synthelabo, Merck |
| Dr. John F. Butterworth | Organizational Reviewer - Society of Cardiovascular Anesthesiologists | None |
| Dr. Harry J. D'Agostino, Jr. | Organizational Reviewer - Society of Thoracic Surgeons | None |
| Dr. Constance K. Haan | Organizational Reviewer - Society of Thoracic Surgeons | None |
| Dr. Elliott M. Antman | Content Reviewer - ACC/AHA Task Force on Practice Guidelines | Research Grants: Bristol-Myers Squibb, Sanofi-Synthelabo, Millennium, Merck, Eli Lilly |

**Note**: This table represents the relationships of peer reviewers with industry that were disclosed at the time of peer review of this guideline. It does not necessarily reflect relationships with industry at the time of publication.

*Participation in the peer review process doest not imply endorsement of the document.
**Names are listed in alphabetical order within each category of review.

## ENDORSER(S)

American Association of Thoracic Surgery - Medical Specialty Society
Society of Thoracic Surgeons - Medical Specialty Society

## GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: American College of Cardiology, American Heart Association, Eagle KA, Guyton RA, Davidoff R, Ewy GA, Fonger J, Gott JP, Herrmann HC, Marlow RA, Nugent WC, O'Connor GT, Orszulak TA, Rieselbach RE, Winters WL, Yusuf S, Gibbons RJ, Alpert JS, Eagle KA, Garson A Jr, Gregoratos G, Russell RO, Smith SC Jr. ACC/AHA Guidelines for coronary artery bypass graft surgery. J Am Coll Cardiol 1999 Oct;34(4):1262-347.

This document will be reviewed one year after the date of publication and yearly thereafter by the Task Force to determine whether a revision is needed. The guidelines will be considered current, unless the Task Force publishes revisions or a withdrawal.

## GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Cardiology (ACC) Web site.

Print copies: Available from ACC, Resource Center, 9111 Old Georgetown Rd, Bethesda, MD 20814-1699; (800) 253-4636 (US only). Also available from the American Heart Association (AHA), Public Information, 7272 Greenville Ave, Dallas TX 75231-4596; Reprint No. 71-0281.

## AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Eagle KA, Guyton RA, et al. ACC/AHA 2004 guideline update for coronary artery bypass graft surgery: summary article. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1999 Guidelines for Coronary Artery Bypass Graft Surgery).

  Electronic copies: Available in Portable Document Format (PDF) format from the American College of Cardiology (ACC) Web site.

- ACC/AHA pocket guideline. Coronary artery bypass graft surgery. Dallas (TX): American College of Cardiology/American Heart Association. 2005 Mar. 58 p.

  Electronic copies: Available in Portable Document Format (PDF) format from the ACC Web site. A Palm Download is also available.

Print copies: Available from ACC, Resource Center, 9111 Old Georgetown Rd, Bethesda, MD 20814-1699; (800) 253-4636 (US only). Also available from the American Heart Association (AHA), Public Information, 7272 Greenville Ave, Dallas TX 75231-4596; Reprint No. 71-0281.

## PATIENT RESOURCES

None available

## NGC STATUS

This summary was completed by ECRI on December 29, 1999. The information was verified by the guideline developer on April 17, 2000. This summary was updated by ECRI on October 13, 2004. The updated information was verified by the guideline developer on November 3, 2005. This summary was updated by ECRI on March 6, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Coumadin (warfarin sodium). This summary was updated by ECRI Institute on September 7, 2007 following the revised U.S. Food and Drug Administration (FDA) advisory on Coumadin (warfarin). This summary was updated by ECRI Institute on November 6, 2007, following the U.S. Food and Drug Administration advisory on Antidepressant drugs.

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